Module 5: Problem Analysis and Decision-Making

MODULE PREVIEW

Managers and supervisors must be able to define problems in the workplace and decide what actions must be taken when an issue or event has a negative impact on employees or the organization.

Problem analysis and decision-making are necessary managerial and supervisory skills. Ultimately, good manager decisions help to achieve LANL's mission. Thorough investigations, timely occurrence reporting, and sharing of lessons learned are also important.

This module is divided into four sections: (1) Performance Measures, (2) Problem Analysis and Decision-Making, (3) Occurrence Investigating and Reporting and (4) Lessons Learned.

Some documents discussed in this module can be found online on the World Wide Web (WWW). These web locations are shown in the margins. The starting point for locating DOE Orders is shown at the right.

http://
iosun.lanl.gov:2008/

PERFORMANCE MEASURES

The University of California (UC) and DOE agreed that UC will utilize a performance based management system for LANL oversight. This performance based management system will include the use of clear and reasonable objective performance measures agreed to in advance as standards. UC will conduct an ongoing self-assessment process, including self-assessments performed at the Laboratory, as the principle means by which to evaluate compliance with the performance measures which are contained in Appendix F of the UC/DOE contract. UC and DOE agreed that a specially designed process described in Appendix F, Section B, will be used to evaluate administrative, scientific, engineering, and technical work of the Laboratory. DOE is responsible for providing programmatic and administrative appraisals and reviews of the Laboratory's and UC's performance of authorized research and development programs in accordance with the terms and conditions of the contract. DOE shall conduct a validation program to appraise and evaluate the performance of the

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Web/cgi_scripts/
cmx_pg1.cgi

work under this contract. Annually, the Contracting Officer shall provide a written assessment of the Laboratory's performance to UC which shall be based upon the DOE appraisal program and the Contracting Officer's evaluation of UC's self-assessment. The contract can be found online.

A performance measure is a set of quantitative data that may be correlated with the performance of a facility or project. Performance measures indicate problems, performance and process improvements, and criteria for evaluation. They provide data for trend analysis and for continuous quality improvement (CQI) initiatives.

The following are characteristics of performance measures:

- they support safety and efficiency of facility operations and demonstrate compliance with DOE and other federal/state/ local requirements;
- they include measurable performance criteria that reflect the range of anticipated performance at the facility;
- they are practical and easily understood;
- they provide a basis for self assessment by LANL management;
- they are readily available on a timely basis; and
- they are applied to business and financial functions.

The challenge for the Laboratory's CQI effort is to use performance measures for beneficial operational performance improvement efforts. Improvements may include:

- reduction in accidents/incidents;
- increased productivity; and
- decreased downtime.

PROBLEM ANALYSIS AND DECISION-MAKING

Events can occur that adversely affect safeguards and security, operations, personnel safety, the public, and the environment. All events need to be thoroughly investigated to ensure that the root cause is determined and that the event does not recur. When events fall into the definition of a reportable occurrence (unusual, off-normal, and emergency) as defined in DOE O 232.1 *(Occurrence Reporting and Processing of Operations Information),*

managers and supervisors must ensure that all investigations, notifications, and reports fulfill the requirements of DOE O 232.1, its attachments, DOE Manual 232.1-1, and appropriate LANL policy and procedure documents. These events will be discussed in the Occurrence Investigations and Reporting section of this module.

According to DOE Order 5480.19 *(Conduct of Operations Requirements for DOE Facilities),* the following conditions and situations provide some of the criteria for when an investigation should be required:

- design limits are violated;
- facility system performance or a safety condition that is unusual, abnormal, or unexplained;
- safety or system features that are improperly positioned;
- reportability to DOE or other agencies (EPA, etc.) is appropriate;
- an unplanned shutdown or significant loss of operation occurs;
- a procedural violation or personnel error occurs that caused or could have caused serious personnel injury or equipment damage or could have affected facility safety;
- equipment failure occurs that could affect facility capability or safety;
- radiological or toxic material limits are exceeded or radioactive or toxic material is lost and/or released;
- actual or attempted sabotage is suspected;
- chemistry or process parameters are out of specification or indicate unexplained trends;
- management or the facility safety review committee deems an investigation is appropriate;
- loss of special nuclear material; and
- repetitive problems occur.

The above list is not intended to be all inclusive. At the discretion of the manager, other specific problems or conditions should receive a formal investigation. Managers and supervisors must also ensure that appropriate procedures are followed if any of the above are reportable occurrences.

Near-miss situations should also receive a formal review at the discretion of the responsible supervisor. A near-miss situation is one in which an inappropriate action occurs (or a necessary action is omitted) but is detected and corrected before an adverse effect on personnel or equipment results. It is important to review near-miss situations to uncover aspects that, if not identified and corrected, can cause recurrence of the event, possibly with more serious consequences. In general, any event (good or bad) whose analysis and documentation would benefit the organization (or others) should be critiqued and investigated. Acts of known or suspected sabotage represent special cases for event investigations. Any known or suspected act of sabotage requires immediate action and should be reported to facility management. It is important to begin a proper investigation immediately to accomplish the following:

- determine the condition of the affected system(s) and ensure the operability of all safety-related systems;
- decide if continued operation is justified or if systems are available to support safe facility shutdown; and
- minimize the impact of discovered acts of sabotage and deter future acts of sabotage.

Investigation Responsibility

Management has overall responsibility for the consistency and thoroughness of problem investigations. Specific investigations or portions of investigations may be delegated to other personnel, remembering that reportable occurrence investigations are done through ESH-7, Occurrence Investigation Group. Examples of specific tasks of an investigation that may be delegated include gathering necessary records, conducting interviews, recommending restart following a reactor trip, and determining the long-term corrective action to prevent recurrence. The credibility of the investigative process is highly dependent upon the knowledge and experience of the individuals performing the investigation. These individuals should be:

- technically knowledgeable and well respected by the facility staff;
- non-biased nor have a vested interest in the results of the investigation; and
- trained in techniques for conducting an investigation.

Define the Problem

In general, to resolve problems begin by defining the problem clearly and accurately. Gather information about all known factors. Analyze and write a clear, concise statement defining the core problem. If the problem can't be defined, an effective solution can't be reached. Ask the following questions:

- What is the problem?
- When did it happen?
  - relative to time
  - relative to other parts of the event
- Where did it happen?
  - physical location
  - relative to associated components or events
- What is the significance?
  - relative to the goals and mission of the organization

Collect the Data: To ensure that all pertinent information is included in the problem definition, formally collect relevant data. Distracting or irrelevant information is eliminated and the manager or review team can get a precise picture of what has happened or what they are dealing with. Include all appropriate information to help the investigative personnel analyze the problem. In keeping with formality of operations, all data concerning an event should be collected and retained.

Collecting information in a timely manner minimizes the possibility of losing information or that observers of the event will be unavailable.

Information should be gathered in the following areas:

- initial facility conditions;
- statements from facility personnel involved in the event;
- pertinent computer printouts;
- pertinent documentation (such as radiation work permits and radiological surveys) as required to establish conditions prior to and during the event; and
- post-incident facility conditions.

Personnel observing or participating in an event can provide insight into the facility response during the event and into actions leading up to the event that would not be available from hard-copy data.

Reconstruct the Event: After data is collected, conduct a structured review or critique of the event. The format of the investigation depends upon the significance, severity, and potential consequences of the event. Include a chronological list of steps and a list of the personnel involved in the event in the reconstruction process.

Analyze the Problem

The Laboratory and DOE uses root-cause analysis as a tool for analyzing problems that led to an event or a near miss because it has been demonstrated as an effective tool in the commercial nuclear facilities; the aviation, automobile and chemical industries; and for military organizations to prevent event recurrence.

Root-Cause Analysis: A root cause is defined as the most basic causal factor or factors that, if corrected, will prevent recurrence of an undesirable event. Many events have several root causes. It is often convenient to select the factor affecting the broadest range of similar events as the root cause, and listing other factors as contributing or direct causes. Contributing causes add to an event but, by themselves, could not have caused the occurrence. A direct cause is that which directly resulted in the event. Reportable events are analyzed by the occurrence reporting process, which includes root-cause analysis. Generally, root-cause analysis includes any method(s) to identify the root cause of an event, the contributing cause(s), and associated corrective actions. This technique builds a logical framework to determine the root cause rather than perceived causes and helps prevent recurrence of problems.

The DOE complex applies root-cause analysis out of concern for the welfare of workers, the Laboratory, the public, and the environment as well as for economic factors. Undesirable events cost taxpayer dollars. The law requires use of root-cause analysis for events covered by the Occupational Safety and Health Act (OSHA). The DOE requires root-cause analysis for compliance with DOE Orders 4330.4B *(Maintenance Management Program)*, 5480.19, and DOE O 232.1.

Methods of Root-Cause Analysis: There are several methods, or processes, that can be employed to perform root-cause analysis. Each method has a specific outcome. Select a method that will uncover the root cause in a manner most useful to the specific problem. The following are several of the most commonly used methods:

Cause and Effect: This process starts with the defined problem and uses deductive logic to identify the correct cause(s) and the effect chain for a given event. The process continues until the root cause is reached.

Cause -Tree Analysis: This approach uses management oversight and risk-tree analysis. This technique is used when experts aren't available to ask the right questions, whenever the problem is recurring, or when solving programmatic problems.

Barrier Analysis: This method looks at the problem by considering the work process as a set of physical or administrative barriers that control the flow of work. Barrier Analysis is a two-step process**.**

(1) Change Analysis—Compares what happened to what should have happened and analyzes the difference.

(2) Personnel Performance (Performance Evaluations)—Useful when people are involved in the cause of the problem as it does not place blame on any individual(s) but determines responsibility.

Cause and Effect Summary Statement: After the root cause has been determined, a cause and effect summary statement is prepared.

A good summary statement includes the following information:

- problem definition with primary effect;
- caused by, caused by, etc.;
- root causes stated; and
- root-cause categories stated.

An example might be a pump that tripped because the over current logic tripped the breaker. The over current did exist, and was caused by the pump shaft seizing, which was caused by a lower thrust bearing failure, which was caused by a lack of lubrication, which was caused by a plugged oil supply line. The plugged line was caused by a piece of plastic. The piece of plastic came off the oil reservoir filling device, because the mechanics failed to remove it when adding oil. They did not remove it because they did not know they had to. They did not know because they were never instructed to do so. It was also determined that the plastic coupling serves no purpose. Therefore, the root causes are improper design application and less-than-adequate operating instructions.

Verify the Root Cause

Verification is done by an independent subject matter expert (SME) or a team of experts. Several elements comprise the verification process and are important in verifying the root cause and not the perceived cause. If this step is skipped, a solution may be picked that does not solve the problem or that may create a new problem.

A thorough verification considers the following:

- The consequences of improperly defining the problem resulting in an improper solution and possibly a repeat event. Include facts not opinions.
- Assure that blame has not been placed (Will placing blame prevent recurrence?).
- Don't stop too soon. Always ask two more "whys" beyond where you think you are going to stop.
- Beware of the problems of using a consensus vote. Voting on a root cause will not make it correct.
- Time is not the root cause. Things happen *in* time not *by* time. We often use time as an excuse, because we cannot control it.
- Question a root cause that passes the buck. The most common reason given for why something cannot be done is because the people involved claim they have no control over the situation. Look very closely at the facts, as it is often an invalid assumption.

Correct the Problem

Problems are solved by taking some type of corrective action. Before taking action two things must be done. First, decide what action to take and second, develop an action plan. A corrective action is a prescriptive plan of action to resolve a specific problem and to prevent its recurrence.

The root-cause analysis process may find more than one action that will correct any one root cause.

Management's decisions can affect other LANL organizations, workers, the public, and the environment. Therefore, it is necessary to look at alternative feasible solutions to make the most appropriate decisions. Verification questions to be asked about corrective action include:

1. Is it within the control of the affected organization?
2. Is it commensurate with the stated root cause(s)?
3. Will it indeed prevent recurrence?
4. Does it meet the goals of the organization?
5. What are the consequences of implementing it?
6. What are the consequences of not implementing it?

Decision-Making: When making significant and important decisions for corrective actions, use the following guidelines:

- *Search for options:* Generate ideas—step out of the paradigm, the typical way of thinking, to search for fresh strategies. Adjust the perspective beyond the immediate issues of seeking solutions.
- *Check for fit:* Consider the absolute requirements to be met. Make sure the boundaries are actual and not just perceived. Match the new ideas to requirements and roadblocks. Determine what support is required to implement the solution. Pick the best choice.
- *Assess your decision-making approach:* Use both intuitive and analytical approaches for decision making if possible.

  (1) Intuitive — Decision-making based on feelings without using logic or reason. This approach may be appropriate when creating ideas that provide a starting point for fresh thoughts, solving the “why” or the “should I” questions, and breaking a deadlock in your mind among different strategies

  (2) Analytical — Decision-making using logic to examine and measure a problem. This approach may be appropriate when (a) separating workable ideas from impractical ones, or (b) solving “how to” or “how many” problems when choices can be assessed with facts.

  Both quantitative and qualitative techniques should be used, depending on the situation. Managers and supervisors rely on quantitative techniques to analyze complex issues. Qualitative decision making helps mangers and supervisors take action with partial information, when issues are gray—not black and white—and without time to complete a full analysis.

No matter what decision-making technique is chosen, all include the following basic steps:

- identify and rank needs and wants;
- consider options and their associated consequences, alternatives, pros, and cons;
- determine the level of risk that can be accepted;
- eliminate options that present an unacceptable risk or least benefit; and
- develop action steps and milestones.

Decision-Making Pitfalls: There are several practices to avoid when making decisions. Four of these are listed below.

- *Group Think (conforming to group values or ethical standards)*: This occurs when team members strive for consensus at the cost of realistic analysis and critical thought. Individuals suppress their ideas and normal skepticism to reach agreement and preserve human relations. Group Think happens subconsciously when we turn off our critical thinking in favor of reaching a decision and group solidarity.

  The eight symptoms of Group Think are:

  (1) Illusion of invulnerability (can not make a "wrong" decision)

  (2) Belief in inherent morality of the group (any external ideas are weak and unintelligent)

  (3) Rationalization

  (4) Stereotypes of outsiders (we/they)

  (5) Self-censorship (devalue own ideas)

  (6) Direct pressure on dissenters (pressure to conform)

  (7) Mind guards (conceal or withhold information)

  (8) Illusion of unanimity (conflict avoidance, group norm is agreement)

  Of course, group cohesiveness is necessary, but beware of making a decision for the sake of preserving relations among group members and for preserving the image of the group. Also, beware of consensus that is reached too quickly with no questioning, or if opinions of other groups are discounted without consideration.

To avoid Group Think, try the following:

- create an open climate where ideas may be openly questioned;

- avoid the isolation of the group, bring in outsiders;

- assign facilitators;

- avoid being too directive;

- recognize that the uncommon idea may be the best solution and look to unlikely sources for answers; and

- lead by example.

- *Unrealistic expectations for yourself or your employees*: Poor decisions occur occasionally so accept the lessons learned and move on.
- *Knee-jerk reactions*: When pressured for time, go through a process within the schedule available and accept the best judgment.
- *Unnecessary action steps*: Avoid action steps that exceed necessary and sufficient action.

Writing the Action Plan: An action plan is a vital tool for continuous quality improvement, correcting processes, and preventing recurrence of a problem. Two types of problems recognized by LANL are audit findings and non-audit findings (such as occurrences, process improvements, productivity enhancements, and good business practices).

In general, when developing an action plan consider the:

- cost of the corrective action;
- complexity of the changes; and
- time required to put it into effect.

The following three items should be included in the final written corrective action plan. Other data may be supplied depending on the action plan form in use at the time.

(1) the problem statement;

(2) the corrective action; and

(3) the schedule (with milestones).

The action plan writer and the appropriate manager must always consider the impact on operations and cost-benefit of the corrective action. For assistance and information about corrective action plans for audit findings contact the Audits and Assessments Office.

Follow Up

After corrective actions have been completed, the actions should be verified. Verification is the process used to substantiate that the corrective actions have been completed. The process may include sampling, inspection, testing, reviewing objective evidence, or other methods determined appropriate. Each organization should continually track progress toward action plan completion, maintain appropriate objective evidence documentation, and conduct an internal verification if necessary to ensure that the completed corrective actions have satisfactorily addressed the problem.

If corrective action requires an independent verification outside the responsible organization, the Audits and Assessments Office can serve as the independent verifying organization. The appropriate line manager should sign for completion of internal and external audit findings after the action plan completion has been verified.

OCCURRENCE INVESTIGATING AND REPORTING

An occurrence is any event or condition in a facility that may adversely affect health, safety, security, property, operations, or the environment. Occurrence reporting is a formal reporting system that keeps both Laboratory managers and the DOE informed of occurrences at facilities.

http://iosun.lanl.gov:2001/htmls/policy/esh/operations.html

PRD120-01 *(Occurrence Investigating and Reporting Program)* defines the elements necessary to implement DOE O 232.1 and DP120 *(Occurrence Reporting)* at the Laboratory. The purpose of the program is to provide thorough, in-depth investigations of occurrences that meet the requirements and criteria of DOE Order 5480.19, 5484.1 *(Environmental Protection, Safety, and Health Protection Information Reporting Requirements),* and DOE O 232.1. Lab procedure LP120-01 *(Occurrence Investigating and Reporting)* assists managers and supervisors in meeting the requirements of all of the above. These documents are available online.

Every worker has the following responsibilities if an occurrence is observed:

- notify the supervisor immediately;
- preserve the scene;
- support the investigation; and
- comply with any corrective actions.

All occurrences must be immediately reported to the facility manager. The responsibilities of the facility manager are called out in detail in PRD120-1, LP120-01, and the *Occurrence Investigating and Reporting Manual*. This manual can be obtained from ESH-7. ESH-7 manages the Occurrence Investigating and Reporting (OI&R) Program at LANL. For more information contact ESH-7 at 5-0033. A more detailed course in the OI&R program is given by ESH-13, ES&H Training.

http://eshtraining.lanl.gov/

Figure 5-1 shows the OI&R program process flow. Included in Phase I is the critique of the event or condition. This step is important because it provides immediate reconstruction, documents the facts, and establishes further lines of inquiry. It also verifies the adequacy of the immediate actions and helps to establish target completion dates for corrective actions.

Phase II includes the investigation of the occurrence, the update reports, and the causal analysis of the occurrence. Here is where root cause analysis comes in.

Phase III is where corrective action plans are written and final evaluation and reports are completed. Lessons learned are also developed in this phase as part of the final report.

Corrective actions are tracked and brought to closure in Phase IV. ESH-7 maintains the records of corrective action plans, responsibilities, and action completion dates for all reportable occurrences at LANL. They are also responsible for updating the DOE/ORPS (Occurrence Reporting and Processing System) databases for LANL occurrences.

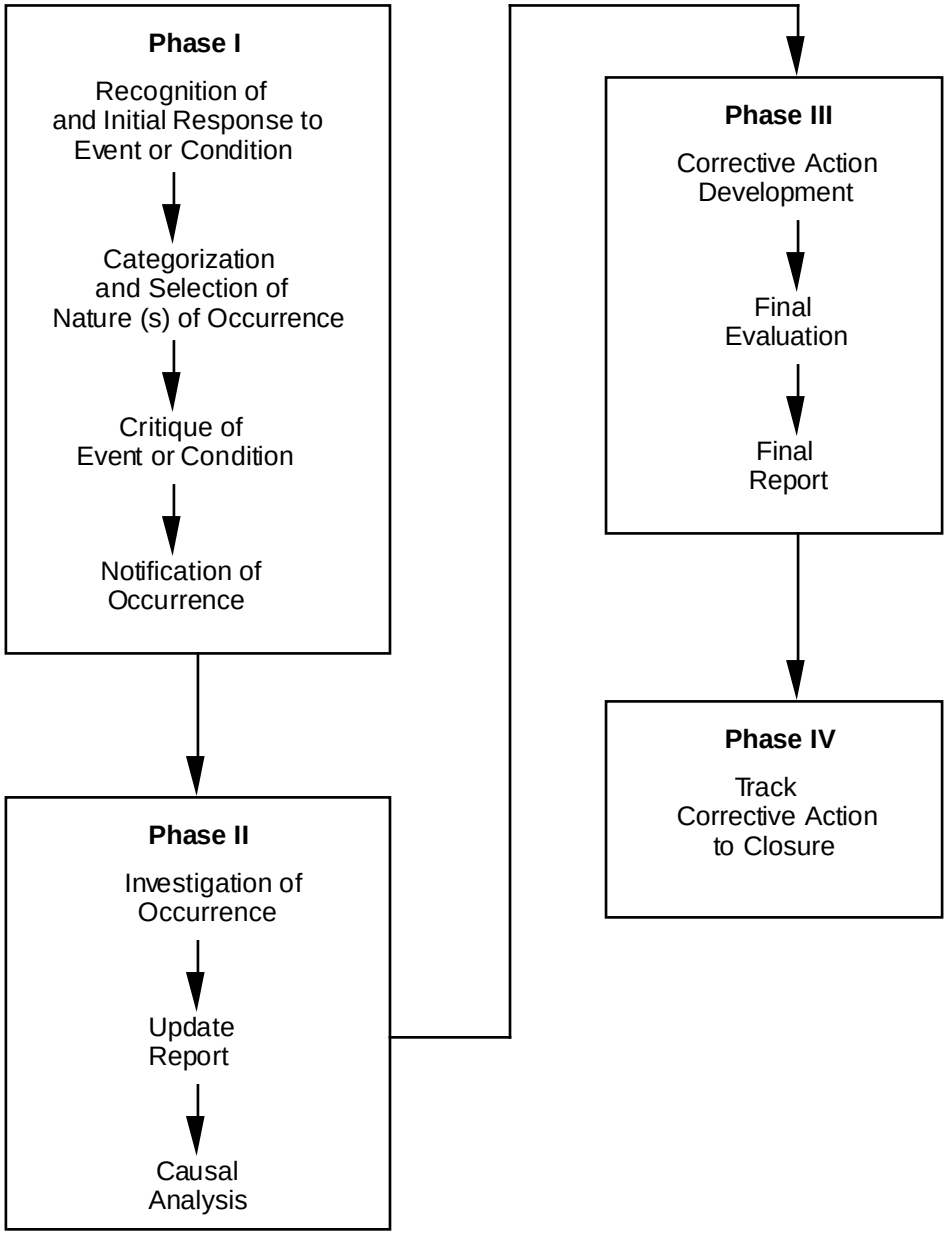

Figure 5-1 Occurrence Investigating and Reporting Process Flow

LESSONS LEARNED

From occurrence reporting, lessons learned can be developed. Lessons learned information helps to improve operations, quality, and to develop a prevention-based culture through sharing and learning from others' experiences. Lessons learned from occurrences, operating experiences, and good work practices are shared among Laboratory and DOE organizations to improve operations and prevent similar occurrences in the future. By sharing information through lessons learned, Laboratory operations are improved. Lessons learned are good work practices or innovative approaches that are identified and shared, or are adverse work practices or experiences that are shared to avoid recurrence.

The purpose of distributing lessons learned is to build a prevention-based safety culture by enabling Laboratory and contractor personnel to become aware of and share relevant experiences from inside and outside of the Laboratory. Patterns of deficiencies should be trended to identify areas requiring corrective action, training, or additional requirements. In addition, event causes should be tracked to identify the effectiveness of existing processes, training, and procedures.

The mission of LANL's Lessons Learned Program is to promote organizational learning through sharing operating experiences. The program contributes to LANL's scientific and technological excellence by disseminating information aimed at increasing organizational and operational effectiveness, efficiency, and safety.

Lessons learned provides opportunities for managers and supervisors to learn about relevant experiences and root causes and to apply them to their own operations, policies, procedures, and resource support. They also encourage appropriate improvements in Laboratory operations by conveying LANL's, DOE's, and the private sector's good work practices and operating experience incidents.

The LANL ES&H Lessons Learned Program facilitates communication of issues related to environment, safety and health requirements, safeguards and security, and other support and management operations resulting from the occurrence investigation process. This is done by ESH-7 through the following:

- *LANL Operating Experience Summary:* This publication provides LANL and DOE complex personnel with information on reportable occurrences. Distribution includes managers and workers. This publication also includes information from non-LANL reports that are relevant to the Laboratory.

- *All-Hands Bulletins:* These documents are one-page, single-subject bulletins created for posting in conspicuous points in the work place. These are published every other month and contain general information that pertains to all workers at the Laboratory.
- *Daily Operation Event Report:* These reports summarize occurrence reporting activities at the Laboratory for the previous 24 hours. Only preliminary information is contained in these reports and they are distributed only to DOE Los Alamos Area Office, to LANL Facility Managers and managers of organizations that had reportable occurrences in the last 24 hours, and to all members of ESH-7.
- *ESH Division Managers Briefing:* ESH-7 provides the managers of ESH Division with a weekly briefing on occurrence reporting activities. Some updated information may be provided at this time on earlier occurrences.

ESH-7 also manages the DOE Lessons Learned List server (on electronic mail) for LANL which is used to distribute lessons learned information to the subscribers. For more information about the DOE Lessons Learned Service, see the WWW location listed in the margin.

http://www.tis.eh.doe.gov:80/others/ll/ll.html

MODULE SUMMARY

This module discussed what to do when problems occur that have a negative impact on employees or the organization. The five-step method to problem solving, as well as root-cause analysis, help to determine exactly how problems impact the organization. A systematic approach to corrective action can solve problems and prevent them from happening again. Managers and supervisors must be well skilled in problem analysis and decision-making in order to maintain the vitality and success of the Laboratory.

SELF ASSESSMENT

Scenario

Two radiation workers discovered skin contamination while exit-monitoring after loadout of contaminated equipment to waste containers. While manually handling small, cutup, sharp-edged pieces of contaminated, hot-cell equipment, individual ‘A’ noticed a

cut in his outer layer of anti-contamination (Anti-C) gloves. After notifying the Radiation Control Technician (RCT), the worker was directed to leave his work area in a safe condition and begin exiting the work area. Individual 'A' removed his outer glove and found a cut on the next layer. The cut was taped and a new layer of gloves provided to the worker so he could safeguard his work. Once the work was in a safe condition, individual 'A' exited the work area and doffed his personal protective equipment (PPE). Individual 'A' discovered all three layers of his glove had been cut. Underneath, he had a small skin abrasion. The abrasion was not bleeding. Individuals 'A' and 'B' proceeded to the half-body monitor, where contamination was discovered.

Facility management conducted a post-job review and made all the proper notifications. During the review, individual 'A' stated that the contaminated equipment consisted of large pieces covered by smaller pieces. In order to place the largest, heaviest pieces in the waste container first, the smaller pieces were moved out of the way. Individual 'A' was aware that the equipment had been cut, and that he should have been concerned about sharp edges. The Direct Cause of the incident was inattention to detail.

The supervisor in charge gave a pre-job briefing. Although the supervisor told his workers that the equipment consisted of cutup material, he did not mention that potential cuts to PPE might occur, or how to prevent them. The Root Cause of this occurrence was inadequate work planning. The supervisor did not recognize the potential hazards and take them into consideration.

Questions

(1) Once individuals 'A' and 'B' recognized the contamination, facility management conducted a post-job review. This was the right thing to do because

a. it is important for 'A' and 'B' to get to tell their side of the story.

b. it is important to begin a proper investigation immediately.

c. it is necessary for fixing blame.

d. if too much time elapses, 'A' and 'B' will have different contamination counts.

(2) The investigation team was able to determine a direct cause and a root cause in the above scenario. Assuming the investigation was conducted properly, after the root cause was determined, it should have been

a. revisited two more times.

b. challenged by the affected workers.

c. verified by an independent subject matter expert.

d. sent to DOE.

(3) After the investigation and reporting of the above incident, management would have developed some lessons learned. The purpose of a lessons learned program is

a. to build a prevention-based safety culture by providing awareness of relevant experiences.

b. to build a collection of interesting stories to read and reinforce how well your facility operates.

c. so your facility workers can feel superior when they look at other facilities.

d. all of the above

Answers

1-b; 2-c; 3-a